

CLAIMS

1. A transfixing assistance device for transfixing a blood vessel on one or more hooks of an anastomotic connector, said transfixing device comprising:
 - 5 a handle defining a longitudinal axis; and
 - an extension projecting from said handle comprising an orifice at its end, said extension being offset at an angle to said longitudinal axis so that, when said handle is rotated during said transfixing, said tip circumducts at a radius corresponding to its offset angle to said longitudinal axis, said radius suitable for everting a graft over a spiked anastomotic connector.
- 10 2. A transfixing assistance device according to claim 1, wherein said orifice is adapted to transfix blood vessel tissue on said one or more connection hooks without damaging said tissue.
- 15 3. A transfixing assistance device according to claim 1, wherein said device comprises two or more opposable extension projection from said handle, arranged to function as a forceps.
4. A transfixing assistance device according to claim 1, wherein said orifice comprises a
20 closed aperture.
5. A transfixing assistance device for transfixing a blood vessel on one or more hooks of an anastomotic connector, said transfixing device comprising:
 - two elongate members attached at a base thereof;
 - 25 an orifice adapted to transfix blood vessel tissue on said one or more connection hooks without damaging said tissue, defined on at least one of said members.
6. A method of guiding hooks of an anastomotic connector into an aperture of a blood vessel, comprising:
 - 30 surrounding said hooks with a mechanical element that compresses them towards each other;
 - inserting said compressed hooks into an aperture of a blood vessel; and
 - releasing said hooks.

7. A method according to claim 6, wherein surrounding comprises protecting said hooks from tissue adjacent said vessel.
- 5 8. A method according to claim 6, wherein surrounding comprises inserting said hooks into a guide.
9. A method according to claim 6, wherein surrounding comprises inserting said hooks into a hook arranger.
- 10 10. A method according to claim 6, wherein surrounding comprises inserting said hooks into a wire loop.
11. A hook arranging device for arranging a plurality of anastomotic hooks projecting from
15 an anastomotic connector, said hook arranging device comprising:
one or more arranging plates adapted to arrange a plurality of hooks of an anastomotic connector; and
a coupler adapted for coupling said at least one plate to an anastomotic connector delivery system.
- 20 12. An arranging device according to claim 11, wherein said one or more plates are removably connected to said delivery system.
13. An arranging device according to claim 11, wherein said one or more plates comprise
25 two edges that presses said plurality of hooks between them.
14. An arranging device according to claim 11, wherein said one or more plates comprise one or more spacers that space two or more of said plurality of hooks.
- 30 15. A guide for guiding a plurality of anastomotic hooks into a blood vessel, said guide comprising:

a guide tip adapted to be placed through an aperture in a blood vessel, said tip being further adapted to guide a plurality of hooks into said blood vessel without contacting said aperture; and

at least one guide wall attached to said tip, said at least one wall being adapted to guide
5 said plurality of hooks toward said tip while protecting said hooks from contacting tissue in proximity to said aperture.

16. A guide according to claim 15, wherein said tip is adapted to protect said hooks from contacting the edges of said aperture during said guiding.

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17. A guide according to claim 15, wherein said tip comprises a blunt end.

18. A guide according to claim 15, wherein said tip comprises a sharp end adapted to form said aperture.

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19. A guide according to claim 15, wherein said at least one wall comprises two or more walls.

20. A guide according to claim 19, wherein said two or more walls are connected to each
20 other.

21. A guide according to claim 15, wherein said guide is adapted to remove from said blood vessel following guiding said plurality of anastomotic hooks.

25 22. A guide according to claim 15, wherein said guide is rotatably mounted on an anastomotic connector delivery system, such that said hooks selectively enter said guide by said rotation.

23. A hook grasper for retractably grasping a plurality of anastomotic connector hooks,
30 comprising:

a handle;

at least one grasping wire projecting from said handle, adapted to grasp and compress a plurality of anastomotic connector hooks; and

a grasping wire controller that controls extension of said extension wire in relation to said handle, such that at one extension, the grasping wire receives uncompressed hooks, at a second extension the grasping wire compresses the hooks and at a third, further extension, the hooks are released.

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24. A hook grasper according to claim 23, wherein said adaptation to grasp a plurality of hooks comprises a curvature adapted for partially encircling a plurality of said hooks.

25. A hook grasper according to claim 23, wherein said adaptation to grasp a plurality of
10 hooks comprises a form of a loop.

26. A hook grasper according to claim 25, wherein said wire defines at least one breakaway area on said wire that breaks when said wire is pulled away taut.

15 27. A hook grasper according to claim 25, wherein said extensions comprises progressive retraction positions of said wire.

28. A hook grasper according to claim 25, mounted on a connector delivery system.

20 29. A hook grasper according to claim 25, comprising a tube into which said wire is retracted between the extension position.

30. A blood vessel cutter for cutting an aperture in a blood vessel, comprising:
a handle having a longitudinal axis;

25 a horn-shaped cutting edge connect to said handle, said cutting edge describing an arc around said longitudinal axis upon rotation of said handle around said longitudinal axis;
whereby, said cutting edge is adapted to cut an aperture in a blood vessel when held proximate to said vessel during said rotation.

30 31. An anastomotic delivery system for delivering an anastomotic connector into a blood vessel and tearing one or more extensions off of said connector, said system comprising:
a puller which is coupled to said extensions;
a manual input operative to retract said puller;

a loaded spring, coupled to said puller;
a selectable interlock which selectively prevents a release of said spring; and
an interlock release, coupled to said manual input, and operative to release said
interlock depending on a retraction of said puller, wherein releasing said interlock releases said
5 spring to tear said extensions.

32. A system according to claim 31, comprising a shock absorber to reduce a delivery of
shock from said spring to a housing of said system, when said spring is released.

10 33. A rotatable anastomotic connector delivery system, comprising:
a handle; and
an anastomotic connector holder rotatably attached to said handle.

34. A rotatable system according to claim 33, wherein said rotator comprises one or more
15 rotational extent rests.

35. A rotatable system according to claim 33, wherein said device comprises a rotational
extent indicator.

20 36. A two part anastomosis delivery system, comprising:
a handle section, adapted to apply force sufficient to deploy an anastomotic connector,
through a coupling thereof; and
a capsule adapted to be removably mounted on said handle and to apply said force
through said coupling to a connector mounted on said capsule.

25 37. A system according to claim 36, wherein said capsule is rotatably mounted on said
handle section.

38. A system according to claim 36, wherein said capsule includes a hook retractor
30 operative to manually retract and extend hooks of said connector.

39. A system according to claim 38, wherein said capsule comprises two axial sections
which rotate one relative to the other to effect said extension and retraction.

40. A system according to claim 38, wherein said capsule comprises an axially moving pin which effects said extension and retraction.
- 5 41. A system according to claim 38, wherein said capsule comprises a pin which rotates around an axis of said capsule to effect said extension and retraction.
42. A system according to claim 38, wherein said handle section prevents access to said hook retractor, when said capsule is mounted on said handle.
- 10 43. A system according to claim 38, wherein said capsule is adapted to not mount on said handle section if said hooks are not in a pre-defined axial position.
44. A system according to claim 38, wherein said capsule comprises a stop which restricts
15 axial motion of said hooks.
45. An anastomotic connector for attaching two blood vessels comprising:
a plurality of eye segments, each defining a channel and each including a part of an interlock mechanism on said channel;
20 a plurality of hook segments, each defining a tissue holding area, each adapted to pass through said channel and including a second part of said interlock mechanism,
wherein, said interlock mechanism engages for a hook and an eye segment when said hook segment is retracted back into said eye segment enough to attach two layers of vascular tissue between said eye segment and said hook segment.
- 25 46. A connector according to claim 45, wherein said hook segment comprises a curved hook tip having a sharpened tissue penetrating tip at its end.
47. A connector according to claim 46, wherein said tip is generally aligned with a center
30 of said eye segment.
48. A connector according to claim 47, wherein said eye segment defines an aperture aligned with said tip.

49. A connector according to claim 48, wherein said eye segment comprises at least one flap in said aperture, to reduce tissue ingress into said aperture.
- 5 50. A connector according to claim 45, wherein said eye segment comprises a body of a closed ring.
51. A connector according to claim 45, wherein said eye segment comprises a body which is open at at least one point of its circumference.
- 10 52. A connector according to claim 45, wherein said interlocking mechanism is stiff enough and strong enough to hold said hook segment while it is being torn off an extension thereof, by pulling on the extension.
- 15 53. A connector according to claim 45, wherein said hook segment includes an extension which is torn off said hook segment during deployment by pulling, said hook segment defining a rest stop where said hook segment is held during said pulling.
54. A connector according to claim 53, wherein said extension defines a slot terminating at said rest stop.
- 20 55. A connector according to claim 45, wherein said interlocking mechanism is substantially all on a plane of said eye segment, once interlocked.
- 25 56. A connector according to claim 45, wherein said interlocking mechanism comprises at least one tab that is perpendicular to an axis of said hook segment, at said channel.
57. A connector according to claim 56, wherein said tab enters a matching aperture formed in said hook segment.
- 30 58. A connector according to claim 56, wherein said tab transfixes a matching aperture formed in said hook segment.

59. A connector according to claim 56, wherein said tab transfixes a matching open slot formed in said hook segment.
60. A connector according to claim 56, comprising at least one spring element which
5 approximates said channel and said tab.
61. A connector according to claim 60, wherein said tab is mounted on said spring element.
62. A connector according to claim 60, wherein said tab is not mounted on said spring
10 element.
63. A connector according to claim 62, wherein said spring element urges said hook element against said tab.
64. A connector according to claim 60, wherein said spring element is formed of an outer
15 portion of said eye segment.
65. A connector according to claim 60, wherein said spring element is attached to said eye segment near said channel.
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66. A connector according to claim 60, wherein said spring element is attached to said eye segment far from said channel.
67. A connector according to claim 60, wherein said eye segment includes a support bar on
25 which said spring element is attached.
68. A connector according to claim 60, wherein said at least one tab comprises only a single tab.
69. A connector according to claim 60, wherein said at least one tab comprises at least two
30 tabs.
70. A connector according to claim 60, wherein said hook element includes an extension

which is torn off during deployment, said extension defining an alternative aperture for locking said tab spaced from said tissue holding area.

71. A connector according to claim 45, wherein said eye segments are interconnected after
5 deployment.

72. A connector according to claim 45, wherein said eye segments are not interconnected after deployment.

10 73. An anastomotic connection clip element, comprising:
a base;
at least one stitching spike, attached to said base and having a sharp end adapted to
penetrate vascular tissue; and
at least one top spike, attached to said base,
15 wherein said stitching spike and said top spike diverge in opposite directions near said
base curve back towards each other away from said base.

74. An anastomotic connection clip element according to claim 73, wherein said spikes
comprises at least one spike of one type and two spikes of the other type, interleaved.
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75. An anastomotic connection clip element according to claim 74, wherein said top spike
is curved to conform to a blood vessel curvature.

76. An anastomotic connection clip element according to claim 74, wherein said element is
25 coupled to a plurality of clip elements, to form a connector.